PATENT ABSTRACTS OF JAPAN

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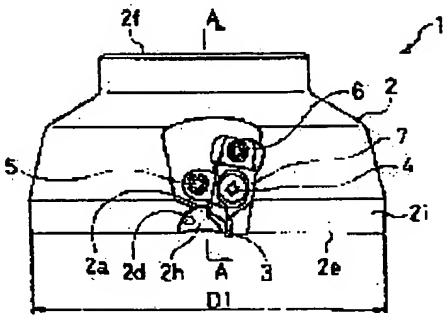
(71)Applicant : HONDA MOTOR CO LTD
(72)Inventor : NISHIKAWA TSUNEO
KITA MASATAKA

(54) MILLING CUTTER

(57)Abstract:
PROBLEM TO BE SOLVED: To allow high-speed rotation, to make a wiper chip unnecessary and to effectively perform circular arc milling, by mounting plural even chips each having a same curved cutting blade of the same curve shape as a cutter body made of aluminum or the like, to the cutter body.
SOLUTION: A cutter body 2 is formed of aluminum or an aluminum alloy having an especially high strength and an especially superior wear resistance. The cutter body 2 is formed in a disc shape such that an outside diameter of the cutter body 2 is gradually enlarged as it goes from an attachment side 2f to a cutting side 2e. A periphery edge part of the cutting side 2e is provided with six cutting parts 2a at even intervals, while each the cutting part 2a comprises a mounting part 2g for a chip 3 and a curved concave part 2h formed with a coolant hole 2d for jetting out a coolant during milling. The chip 3 having a cutting blade 3a formed in a curve shape is fixedly mounted to the mounting part 2g of the cutter body 2 with a screw 4, a side clamp screw 5 and a clamp member 7.



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CLAIMS

[Claim(s)]
[Claim 1] the curve of the same configuration as the cutter body formed with aluminum or an aluminium alloy in the milling cutter used in case milling of the work piece is carried out -- the milling cutter characterized by having two or more chips which have a cutting edge, attaching said same chip in said cutter body altogether, and making milling in high-speed rotation possible.
[Claim 2] The milling cutter according to claim 1 characterized by preparing the coolant hole which is open for free passage in the cutting section in said cutter body, and injecting a coolant during said milling.
[Claim 3] The milling cutter according to claim 1 or 2 characterized by using said milling cutter for an NC machine tool.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the milling cutter which corresponds to high-speed rotation and makes a wiper chip unnecessary especially about the milling cutter used in case milling of the work piece is carried out.
[0002]
[Description of the Prior Art] Conventionally, milling is well used, when cutting the flat surface of a work piece from rough machining to finishing. For example, when performing cutting to work pieces, such as a missions case made from aluminum for automobiles, face cutter processing is adopted. The milling cutter used for face cutter processing attaches two or more chips in a cutter body, and performs cutting by rotation, flat-surface migration, etc.
[0003] The rough machining chip 23 and (b) of (a) are the wiper chips 24 in the typical top view showing the operation under face cutter processing by the milling cutter 21 of the former [drawing 6], and drawing showing the tip configuration of the chip of the milling cutter 21 of the former [drawing 7]. In order to cut the periphery edge surface (drawing 6 slash part) of a work piece W, a milling cutter 21 carries out straight-line migration along the processing direction of drawing 6 while rotating. A milling cutter 21 has six cutting sections 22a in the periphery edge of a cutter body 22 at equal intervals. Five rough machining chips 23 and one wiper chip 24 are respectively attached in six cutting sections 22a. the cutting edge whose rough machining chip 23 is a straight-line configuration -- it has 23a and is an object for rough machining cutting (refer to drawing 7 (a)). the wiper chip 24 -- a cutting edge -- the cutting edge which is the curvilinear configuration (R2=300mm) of the shape of a projection and radii more slightly than 23a -- it has 24a and is an object for finishing cutting (refer to drawing 7 (b)). The wiper chip 24 deletes thinly the processing side cut with the rough machining chip 23 in the shape of radii, and makes a processing side smooth.
[0004]
[Problem(s) to be Solved by the Invention] By the way, since a wiper chip 24 different only one is attached in the cutter body 22, only straight-line processing can be performed in face cutter processing. It is because the part by which finishing cutting is not carried out may remain when radii processing is carried out. Therefore, it learns, if the cutter body 22 which has the larger outer diameter D2 than the maximum width W1 (it is vertical width of face to the straight-line processing direction) of a work piece W is not used when it has a radii configuration like a work piece W, and it is **. A milling machine must also use a large-sized thing with enlargement of a cutter body 22. And a cutter body 22 has large weight because of iron. Therefore, the rotational speed under processing serves as 3000 or less rpm and low-speed rotation, processing effectiveness is low and, moreover, field roughness is also low.
[0005] then -- while the technical problem of this invention has high-speed rotation correspondence and an unnecessary wiper chip -- radii processing -- possible -- and -- high -- suppose that the milling cutter which makes efficiency milling possible is offered.
[0006]
[Means for Solving the Problem] the curve of the configuration as the cutter body formed with

aluminum or an aluminium alloy in the milling cutter used in case milling of the work piece is carried out where the milling cutter concerning this invention which attained said technical problem is the same -- it has two or more chips which have a cutting edge, said same chip is altogether attached in said cutter body, and it is characterized by making milling in high-speed rotation possible.

[0007] And in said milling cutter, the coolant hole which is open for free passage in the cutting section is prepared in said cutter body, and it is characterized by injecting a coolant during said milling.

[0008] Moreover, in said milling cutter, it is characterized by using said milling cutter for an NC machine tool.

[0009] The milling cutter of this invention can respond to milling by high-speed rotation by lightweight-izing a cutter body as a product made from aluminum. Moreover, finish-machining also of a chip with the cutting edge of a small radius is attained by high-speed rotation. Then, a milling cutter comes to be also able to perform radii processing while it attaches the same chip in a cutter body altogether and performs from rough machining to finish-machining. And by preparing a coolant hole in a cutter body and injecting a coolant in the cutting section, the frictional heat generated in cutting can be cooled, and cutting waste, processing weld flash, etc. can be blown away. Furthermore, while equipping an NC machine tool with a milling cutter, it can respond to various processing patterns, such as straight-line processing and radii processing, by NC program set up in order to carry out cutting along with the periphery edge surface of a work piece etc.

[0010]

[Embodiment of the Invention] The milling cutter of the gestalt of operation concerning this invention is explained with reference to an attached drawing below. Drawing where the top view of a milling cutter 1 and drawing 2 show the A-A line sectional view of drawing 1 (a), and, as for drawing 3 , drawing 1 shows the tip configuration of the chip 3 of a milling cutter 1 to (a) at the front view of a milling cutter 1 and (b), the front view of NC machine tool 10 with which drawing 4 equipped with the milling cutter 1, and drawing 5 are the typical top views showing the operation under face cutter processing by the milling cutter 1.

[0011] A milling cutter 1 is the configuration which can inject a coolant (coolant) in six cutting sections 2a while attaching six chips 3 in the periphery edge of a cutter body 2. In addition, six chips 3 have the same configuration altogether. And NC machine tool 10 (refer to drawing 4) is equipped with a milling cutter 1, and a work piece W is performed from rough machining to finish-machining by face cutter processing.

[0012] A cutter body 2 is explained. (Refer to drawing 1 - drawing 2)

A cutter body 2 is formed with aluminum or an aluminium alloy. Also in it, what is excellent in high intensity and abrasion resistance is used. In addition, the ingredients of the cutter body 2 of the gestalt of this operation are <AHS>, T6, and aluminum-Si-Cu-Mg, and are very hard in the ingredient of an aluminum system. A cutter body 2 becomes very lightweight by making it the product made from aluminum as compared with the conventional iron cutter body.

[0013] An outer diameter becomes large gradually, the whole cutter body 2 configuration having a disk configuration, and applying it to cutting side 2e from 2f a wearing side. In addition, the outer diameter D1 of cutting side 2e of a cutter body 2 may be smaller than the maximum width W1 of a work piece W (R> drawing 5 5 reference). It is because milling which meets the periphery edge surface of a work piece W becomes possible since the milling cutter 1 of this invention is the configuration which can be equivalent to radii processing. Therefore, it is not necessary to make it larger than the maximum width W1 of a work piece W like the milling cutter 21 which can respond only to the conventional straight-line processing (refer to drawing 5). In addition, the outer diameter D1 of a cutter body 2 is limited by the spindle 11 (refer to drawing 4) of NC machine tool 10 etc. Moreover, the outer diameter D1 of a cutter body 2 is so effective that it is small, and can be applied to various processings, such as not only field processing but processing of an inside. Consequently, the weight of a cutter body 2 becomes about 1/3 by aluminum-izing and miniaturization as compared with the weight of the conventional cutter body.

[0014] It has feed-hole 2b for equipping with the spindle 11 (referring to drawing 4) of NC

machine tool 10 in a 2f core a wearing side. Feed-hole 2b is open for free passage to opening 2c formed in cutting side 2e. It is equipped with a cutter body 2 and a spindle 11 with the 2nd page restricted electrode holder (not shown) of a middle adapter.

[0015] Moreover, in the periphery edge of cutting side 2e, it has six cutting sections 2a at equal intervals. Cutting section 2a has the structure where neither cutting waste nor processing weld flash is got blocked at the time of cutting while attaching a chip 3. Therefore, cutting section 2a consists of 2g of attachment sections and 2h of curve crevices of a chip 3. 2g of attachment sections has a concave configuration in periphery side-face 2i of a cutter body 2, in order to incorporate the screw 6 for adjustment which is the member which adjusts the location of the screw 4 which is the member which fixes a chip 3 and a chip 3, the screw 5 for a side clamp, the clamp member 7, and a chip 3. On the other hand, 2h of curve crevices has an abbreviation 4 semi-sphere-like concave configuration from the edge of cutting side 2e in periphery side-face 2i of a cutter body 2. Moreover, to 2h of curve crevices, 2d of coolant holes is open for free passage, and a coolant is injected in a cutting part at the time of processing.

[0016] It is respectively formed from the core of a cutter body 2, coolant covering [six / 2d] it over six cutting sections 2a. And 2d of each coolant hole is open for free passage to coolant liquid feed zone 2j of the core of a cutter body 2. From 2d of coolant holes, it is the injection pressure of 70kg/cm2. A very high pressure coolant is injected. Therefore, in addition to the cooling operation over the frictional heat generated between a chip 3 and a work piece W at the time of cutting, the injected coolant also has the operation which flies the cutting waste generated at the time of cutting, processing weld flash, etc.

[0017] Moreover, the balance of a cutter body 2 may be less than [G2.0]. It is because vibration occurs at the time of high-speed rotation and cutting is not stabilized, unless it makes it less than [G2.0].

[0018] A chip 3 is explained. (It is drawing 6 and referring to drawing 7 refer to drawing 1 - drawing 3 and conventionally)

Although a chip 3 is attached in six cutter bodies 2, let it be the same thing altogether. the configuration of a chip 3 -- a cutting edge -- 3a is made into a curvilinear configuration and the radius R1 of the curve is set to 70mm (refer to drawing 3). the cutting edge of the former and wiper chip 24 -- the radius R2 of the curve of 24a is as large as 300mm. The wiper chip 24 is cutting edge 24a of large radii, and is low-speed rotation, and was performing finishing cutting. Therefore, when the conventional milling cutter 21 performed from rough machining to finish-machining, only one wiper chip 24 had to be attached in the cutter body 22 in two or more chips 23 and 24. however, the milling cutter 1 -- a high speed -- making it a pivotable configuration -- a cutting edge -- finish-machining becomes possible even if it makes small the radius R1 of the curve of 3a. In addition, by high-speed rotation, cutting force becomes small and field roughness improves. moreover, a cutting edge -- the radius R1 of the curve of 3a -- the cutting edge of the conventional wiper chip 24 -- an operation of rough machining is also presented by making it smaller than the radius R2 of 24a. Consequently, it becomes possible to perform from rough machining to finish-machining also as the same thing altogether about the chip 3 attached in a cutter body 2. Furthermore, it becomes processible also to the direction of X, Y, and a Z-axis way, and can respond in addition to field processing.

[0019] The attachment structure to the cutter body 2 of a chip 3 is explained. (Refer to drawing 1 - drawing 2)

A chip 3 is fixed to 2g of attachment sections of a cutter body 2 by the screw 4, the screw 5 for a side clamp, and the clamp member 7. first, the clamp member 7 by which the chip 3 was arranged in 2g of attachment sections -- attaching -- the bis-hole (not shown) of a chip 3 -- bis--- 4 is made to screw in and bis-conclusion immobilization is carried out. In addition, on the occasion of this attachment, the angle of the cutting side of a milling cutter 1 and a side face to make is made into 90 degrees (refer to drawing 2). Furthermore, it fixes from the side of a chip 3 on the screw 5 for a side clamp. moreover, the chip 3 -- the screw 6 for adjustment -- it is -- the cutting edge from a cutter body 2 -- the amount of protrusions of 3a can be adjusted.

[0020] As mentioned above, the chip 3 considered the clamp method as the bis-type. Because, since a milling cutter 1 processes it by high-speed rotation and it requires a big centrifugal force

for a chip 3, it is for enlarging fixed reinforcement on a screw 4 and strengthening immobilization with the screw 5 for a side clamp further.

[0021] It is explanation **** about the condition of having equipped NC machine tool 10 with the milling cutter 1. (Refer to drawing 4)

The spindle 11 of NC machine tool 10 is equipped with a milling cutter 1 with a 2nd page restricted electrode holder (not shown). In addition, by using a 2nd page restricted electrode holder, the drawing-in force between a milling cutter 1 and a spindle 11 was raised, and correspondence with the big centrifugal force generated at the time of high-speed rotation was enabled. Moreover, a work piece W is held at the clamp 12 of NC machine tool 10, and cutting is carried out with a milling cutter 1.

[0022] In addition, a milling cutter 1 sets rotational speed to 3000 - 8000rpm during processing by NC machine tool 10. Since cutting force decreases so that it becomes high-speed rotation, field roughness improves. In addition, if 3000rpm, field roughness will fall and processing effectiveness will also fall.

[0023] The operation under face cutter processing by the milling cutter 1 is explained. (Refer to drawing 5)

NC machine tool 10 (refer to drawing 4) is equipped with a milling cutter 1, and it carries out face cutter processing. High-speed rotation processing and radii processing of a milling cutter 1 were attained by lightweight-izing of a cutter body 2, a miniaturization, and identification of a chip 3. Therefore, milling of the processing pattern which combined radii processing and straight-line processing which met the periphery edge surface (the drawing 5 slash section) of a work piece W becomes possible. Moreover, processing of 3 shaft orientations of X, Y, and Z can also be performed freely.

[0024] A milling cutter 1 performs face cutter processing along with the rotation by high-speed rotation, and the periphery edge surface of a work piece W according to a NC machining program. And that rotational speed is high-speed rotation can also shorten acceleration-and-deceleration time amount sharply by lightweight-ization of a cutter body 2. consequently, the former -- comparing -- high -- efficiency face cutter processing is attained. In addition, whenever [acceleration-and-deceleration] can raise about 3 times and processing efficiency to about 5 times conventionally.

[0025] moreover, high-speed rotation -- a cutting edge -- the radius R1 of the curve of 3a -- the cutting edge of the wiper chip 24 -- finish-machining was made possible even if smaller than the radius R2 of 24a (refer to drawing 3 and drawing 7). That is, the small part of a radius R1 is compensated with high-speed rotation. Consequently, a milling cutter 1 becomes possible from rough machining to finish-machining. In addition, it carries out with the rotational speed same from rough machining to finish-machining. and -- since cutting force decreases by high-speed rotation -- field roughness -- the former -- improving -- further -- a cutting edge -- if rotation becomes a high speed even if the radius R1 of 3a is small, field roughness will improve.

[0026] The above-mentioned milling cutter 1 enabled high-speed rotation by lightweight-ization depended on the product made from aluminum. moreover, a high speed -- considering as a pivotable configuration -- the curve of a chip 3 -- a cutting edge -- finish-machining became possible even if it made the radius R1 of 3a small. Consequently, all become possible [from rough machining to finish-machining] also as the same thing about the chip 3 attached in a cutter body 2. And radii processing is attained by having made the chip 3 the same altogether. Therefore, a cutter body 2 can be miniaturized, NC machine tool 10 grade is equipped, and cutting with various processing patterns is attained.

[0027] This invention is carried out with various gestalten, without being limited to the gestalt of the above-mentioned operation. For example, although the chip attached in a cutter body was made into six pieces, it does not limit to six pieces. Moreover, although the radius of the curve of the cutting edge of a chip was set to 70mm, it does not limit to 70mm. Moreover, although rotational speed under processing of a milling cutter was set to 3000 - 8000rpm, it is good also as a larger rotational speed than 8000rpm. Since cutting force decreases so that it is made high-speed rotation, field roughness improves. Moreover, although applied to field processing, it is applicable to various cutting to the inside of a work piece etc.

[0028]
[Effect of the Invention] As mentioned above, the milling cutter concerning this invention can respond to high-speed rotation, and makes a wiper chip unnecessary, and is altogether possible from rough machining to finish-machining with the same chip. Moreover, not only straight-line processing but radii processing becomes possible by making all chips into the same thing. and a cutter body -- a miniaturization -- and a milling machine can also be miniaturized while becoming about 1/3 weight of the conventional cutter body, since it lightweight-ized. Furthermore, while about 3 times and processing effectiveness of spindle acceleration-and-deceleration whenever improve to about 5 times conventionally by enabling correspondence in high-speed rotation, field roughness also improves.
[0029] Moreover, the operation which flies swarf, processing weld flash, etc. also does so with a cooling operation by considering as the structure which injects a coolant in the cutting section. Furthermore, since radii processing etc. can be freed, an NC machine tool etc. is equipped and cutting by various processing patterns is attained.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the milling cutter which corresponds to high-speed rotation and makes a wiper chip unnecessary especially about the milling cutter used in case milling of the work piece is carried out.

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PRIOR ART

[Description of the Prior Art] Conventionally, milling is well used, when cutting the flat surface of a work piece from rough machining to finishing. For example, when performing cutting to work pieces, such as a missions case made from aluminum for automobiles, face cutter processing is adopted. The milling cutter used for face cutter processing attaches two or more chips in a cutter body, and performs cutting by rotation, flat-surface migration, etc.
[0003] The rough machining chip 23 and (b) of (a) are the wiper chips 24 in the typical top view showing the operation under face cutter processing by the milling cutter 21 of the former [drawing 6], and drawing showing the tip configuration of the chip of the milling cutter 21 of the former [drawing 7]. In order to cut the periphery edge surface (drawing 6 slash part) of a work piece W, a milling cutter 21 carries out straight-line migration along the processing direction of drawing 6 while rotating. A milling cutter 21 has six cutting sections 22a in the periphery edge of a cutter body 22 at equal intervals. Five rough machining chips 23 and one wiper chip 24 are respectively attached in six cutting sections 22a. the cutting edge whose rough machining chip 23 is a straight-line configuration -- it has 23a and is an object for rough machining cutting (refer to drawing 7 (a)). the wiper chip 24 -- a cutting edge -- the cutting edge which is the curvilinear configuration (R2=300mm) of the shape of a projection and radii more slightly than 23a -- it has 24a and is an object for finishing cutting (refer to drawing 7 (b)). The wiper chip 24 deletes thinly the processing side cut with the rough machining chip 23 in the shape of radii, and makes a processing side smooth.

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, the milling cutter concerning this invention can respond to high-speed rotation, and makes a wiper chip unnecessary, and is altogether possible from rough machining to finish-machining with the same chip. Moreover, not only straight-line processing but radii processing becomes possible by making all chips into the same thing. and a cutter body -- a miniaturization -- and a milling machine can also be miniaturized while becoming about 1/3 weight of the conventional cutter body, since it lightweight-ized. Furthermore, while about 3 times and processing effectiveness of spindle acceleration-and-deceleration whenever improve to about 5 times conventionally by enabling correspondence in high-speed rotation, field roughness also improves.
[0029] Moreover, the operation which flies swarf, processing weld flash, etc. also does so with a cooling operation by considering as the structure which injects a coolant in the cutting section. Furthermore, since radii processing etc. can be freed, an NC machine tool etc. is equipped and cutting by various processing patterns is attained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, since a wiper chip 24 different only one is attached in the cutter body 22, only straight-line processing can be performed in face cutter processing. It is because the part by which finishing cutting is not carried out may remain when radii processing is carried out. Therefore, it learns, if the cutter body 22 which has the larger outer diameter D2 than the maximum width W1 (it is vertical width of face to the straight-line processing direction) of a work piece W is not used when it has a radii configuration like a work piece W, and it is **. A milling machine must also use a large-sized thing with enlargement of a cutter body 22. And a cutter body 22 has large weight because of iron. Therefore, the rotational speed under processing serves as 3000 or less rpm and low-speed rotation, processing effectiveness is low and, moreover, field roughness is also low.
[0005] then -- while the technical problem of this invention has high-speed rotation correspondence and an unnecessary wiper chip -- radii processing -- possible -- and -- high -- suppose that the milling cutter which makes efficiency milling possible is offered.

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MEANS

[Means for Solving the Problem] the curve of the configuration as the cutter body formed with aluminum or an aluminium alloy in the milling cutter used in case milling of the work piece is carried out where the milling cutter concerning this invention which attained said technical problem is the same -- it has two or more chips which have a cutting edge, said same chip is altogether attached in said cutter body, and it is characterized by making milling in high-speed rotation possible.
[0007] And in said milling cutter, the coolant hole which is open for free passage in the cutting section is prepared in said cutter body, and it is characterized by injecting a coolant during said milling.
[0008] Moreover, in said milling cutter, it is characterized by using said milling cutter for an NC machine tool.
[0009] The milling cutter of this invention can respond to milling by high-speed rotation by lightweight-izing a cutter body as a product made from aluminum. Moreover, finish-machining also of a chip with the cutting edge of a small radius is attained by high-speed rotation. Then, a milling cutter comes to be also able to perform radii processing while it attaches the same chip in a cutter body altogether and performs from rough machining to finish-machining. And by preparing a coolant hole in a cutter body and injecting a coolant in the cutting section, the frictional heat generated in cutting can be cooled, and cutting waste, processing weld flash, etc. can be blown away. Furthermore, while equipping an NC machine tool with a milling cutter, it can respond to various processing patterns, such as straight-line processing and radii processing, by NC program set up in order to carry out cutting along with the periphery edge surface of a work piece etc.
[0010]
[Embodiment of the Invention] The milling cutter of the gestalt of operation concerning this invention is explained with reference to an attached drawing below. Drawing where the top view of a milling cutter 1 and drawing 2 show the A-A line sectional view of drawing 1 (a), and, as for drawing 3 , drawing 1 shows the tip configuration of the chip 3 of a milling cutter 1 to (a) at the front view of a milling cutter 1 and (b), the front view of NC machine tool 10 with which drawing 4 equipped with the milling cutter 1, and drawing 5 are the typical top views showing the operation under face cutter processing by the milling cutter 1.
[0011] A milling cutter 1 is the configuration which can inject a coolant (coolant) in six cutting sections 2a while attaching six chips 3 in the periphery edge of a cutter body 2. In addition, six chips 3 have the same configuration altogether. And NC machine tool 10 (refer to drawing 4) is equipped with a milling cutter 1, and a work piece W is performed from rough machining to finish-machining by face cutter processing.
[0012] A cutter body 2 is explained. (Refer to drawing 1 - drawing 2)
A cutter body 2 is formed with aluminum or an aluminium alloy. Also in it, what is excellent in high intensity and abrasion resistance is used. In addition, the ingredients of the cutter body 2 of the gestalt of this operation are <AHS>, T6, and aluminum-Si-Cu-Mg, and are very hard in the ingredient of an aluminum system. A cutter body 2 becomes very lightweight by making it the product made from aluminum as compared with the conventional iron cutter body.

[0013] An outer diameter becomes large gradually, the whole cutter body 2 configuration having a disk configuration, and applying it to cutting side 2e from 2f a wearing side. In addition, the outer diameter D1 of cutting side 2e of a cutter body 2 may be smaller than the maximum width W1 of a work piece W (R> drawing 5 5 reference). It is because milling which meets the periphery edge surface of a work piece W becomes possible since the milling cutter 1 of this invention is the configuration which can be equivalent to radii processing. Therefore, it is not necessary to make it larger than the maximum width W1 of a work piece W like the milling cutter 21 which can respond only to the conventional straight-line processing (refer to drawing 5). In addition, the outer diameter D1 of a cutter body 2 is limited by the spindle 11 (refer to drawing 4) of NC machine tool 10 etc. Moreover, the outer diameter D1 of a cutter body 2 is so effective that it is small, and can be applied to various processings, such as not only field processing but processing of an inside. Consequently, the weight of a cutter body 2 becomes about 1/3 by aluminum-izing and miniaturization as compared with the weight of the conventional cutter body.
[0014] It has feed-hole 2b for equipping with the spindle 11 (referring to drawing 4) of NC machine tool 10 in a 2f core a wearing side. Feed-hole 2b is open for free passage to opening 2c formed in cutting side 2e. It is equipped with a cutter body 2 and a spindle 11 with the 2nd page restricted electrode holder (not shown) of a middle adapter.
[0015] Moreover, in the periphery edge of cutting side 2e, it has six cutting sections 2a at equal intervals. Cutting section 2a has the structure where neither cutting waste nor processing weld flash is got blocked at the time of cutting while attaching a chip 3. Therefore, cutting section 2a consists of 2g of attachment sections and 2h of curve crevices of a chip 3. 2g of attachment sections has a concave configuration in periphery side-face 2i of a cutter body 2, in order to incorporate the screw 6 for adjustment which is the member which adjusts the location of the screw 4 which is the member which fixes a chip 3 and a chip 3, the screw 5 for a side clamp, the clamp member 7, and a chip 3. On the other hand, 2h of curve crevices has an abbreviation 4 semi-sphere-like concave configuration from the edge of cutting side 2e in periphery side-face 2i of a cutter body 2. Moreover, to 2h of curve crevices, 2d of coolant holes is open for free passage, and a coolant is injected in a cutting part at the time of processing.
[0016] It is respectively formed from the core of a cutter body 2, coolant covering [six / 2d] it over six cutting sections 2a. And 2d of each coolant hole is open for free passage to coolant liquid feed zone 2j of the core of a cutter body 2. From 2d of coolant holes, it is the injection pressure of 70kg/cm2. A very high pressure coolant is injected. Therefore, in addition to the cooling operation over the frictional heat generated between a chip 3 and a work piece W at the time of cutting, the injected coolant also has the operation which flies the cutting waste generated at the time of cutting, processing weld flash, etc.
[0017] Moreover, the balance of a cutter body 2 may be less than [G2.0]. It is because vibration occurs at the time of high-speed rotation and cutting is not stabilized, unless it makes it less than [G2.0].
[0018] A chip 3 is explained. (It is drawing 6 and referring to drawing 7 refer to drawing 1 - drawing 3 and conventionally)
Although a chip 3 is attached in six cutter bodies 2, let it be the same thing altogether. the configuration of a chip 3 -- a cutting edge -- 3a is made into a curvilinear configuration and the radius R1 of the curve is set to 70mm (refer to drawing 3). the cutting edge of the former and wiper chip 24 -- the radius R2 of the curve of 24a is as large as 300mm. The wiper chip 24 is cutting edge 24a of large radii, and is low-speed rotation, and was performing finishing cutting. Therefore, when the conventional milling cutter 21 performed from rough machining to finish-machining, only one wiper chip 24 had to be attached in the cutter body 22 in two or more chips 23 and 24. however, the milling cutter 1 -- a high speed -- making it a pivotable configuration -- a cutting edge -- finish-machining becomes possible even if it makes small the radius R1 of the curve of 3a. In addition, by high-speed rotation, cutting force becomes small and field roughness improves. moreover, a cutting edge -- the radius R1 of the curve of 3a -- the cutting edge of the conventional wiper chip 24 -- an operation of rough machining is also presented by making it smaller than the radius R2 of 24a. Consequently, it becomes possible to perform from rough machining to finish-machining also as the same thing altogether about the chip 3 attached in a

cutter body 2. Furthermore, it becomes processible also to the direction of X, Y, and a Z-axis way, and can respond in addition to field processing.
[0019] The attachment structure to the cutter body 2 of a chip 3 is explained. (Refer to drawing 1 - drawing 2)
A chip 3 is fixed to 2g of attachment sections of a cutter body 2 by the screw 4, the screw 5 for a side clamp, and the clamp member 7. first, the clamp member 7 by which the chip 3 was arranged in 2g of attachment sections -- attaching -- the bis-hole (not shown) of a chip 3 -- bis--- 4 is made to screw in and bis-conclusion immobilization is carried out. In addition, on the occasion of this attachment, the angle of the cutting side of a milling cutter 1 and a side face to make is made into 90 degrees (refer to drawing 2). Furthermore, it fixes from the side of a chip 3 on the screw 5 for a side clamp. moreover, the chip 3 -- the screw 6 for adjustment -- it is -- the cutting edge from a cutter body 2 -- the amount of protrusions of 3a can be adjusted.
[0020] As mentioned above, the chip 3 considered the clamp method as the bis-type. Because, since a milling cutter 1 processes it by high-speed rotation and it requires a big centrifugal force for a chip 3, it is for enlarging fixed reinforcement on a screw 4 and strengthening immobilization with the screw 5 for a side clamp further.
[0021] It is explanation **** about the condition of having equipped NC machine tool 10 with the milling cutter 1. (Refer to drawing 4)
The spindle 11 of NC machine tool 10 is equipped with a milling cutter 1 with a 2nd page restricted electrode holder (not shown). In addition, by using a 2nd page restricted electrode holder, the drawing-in force between a milling cutter 1 and a spindle 11 was raised, and correspondence with the big centrifugal force generated at the time of high-speed rotation was enabled. Moreover, a work piece W is held at the clamp 12 of NC machine tool 10, and cutting is carried out with a milling cutter 1.
[0022] In addition, a milling cutter 1 sets rotational speed to 3000 - 8000rpm during processing by NC machine tool 10. Since cutting force decreases so that it becomes high-speed rotation, field roughness improves. In addition, if 3000rpm, field roughness will fall and processing effectiveness will also fall.
[0023] The operation under face cutter processing by the milling cutter 1 is explained. (Refer to drawing 5)
NC machine tool 10 (refer to drawing 4) is equipped with a milling cutter 1, and it carries out face cutter processing. High-speed rotation processing and radii processing of a milling cutter 1 were attained by lightweight-izing of a cutter body 2, a miniaturization, and identification of a chip 3. Therefore, milling of the processing pattern which combined radii processing and straight-line processing which met the periphery edge surface (the drawing 5 slash section) of a work piece W becomes possible. Moreover, processing of 3 shaft orientations of X, Y, and Z can also be performed freely.
[0024] A milling cutter 1 performs face cutter processing along with the rotation by high-speed rotation, and the periphery edge surface of a work piece W according to a NC machining program. And that rotational speed is high-speed rotation can also shorten acceleration-and-deceleration time amount sharply by lightweight-ization of a cutter body 2. consequently, the former -- comparing -- high -- efficiency face cutter processing is attained. In addition, whenever [acceleration-and-deceleration] can raise about 3 times and processing efficiency to about 5 times conventionally.
[0025] moreover, high-speed rotation -- a cutting edge -- the radius R1 of the curve of 3a -- the cutting edge of the wiper chip 24 -- finish-machining was made possible even if smaller than the radius R2 of 24a (refer to drawing 3 and drawing 7). That is, the small part of a radius R1 is compensated with high-speed rotation. Consequently, a milling cutter 1 becomes possible from rough machining to finish-machining. In addition, it carries out with the rotational speed same from rough machining to finish-machining. and -- since cutting force decreases by high-speed rotation -- field roughness -- the former -- improving -- further -- a cutting edge -- if rotation becomes a high speed even if the radius R1 of 3a is small, field roughness will improve.
[0026] The above-mentioned milling cutter 1 enabled high-speed rotation by lightweight-ization depended on the product made from aluminum. moreover, a high speed -- considering as a

pivotable configuration -- the curve of a chip 3 -- a cutting edge -- finish-machining became possible even if it made the radius R1 of 3a small. Consequently, all become possible [from rough machining to finish-machining] also as the same thing about the chip 3 attached in a cutter body 2. And radii processing is attained by having made the chip 3 the same altogether. Therefore, a cutter body 2 can be miniaturized, NC machine tool 10 grade is equipped, and cutting with various processing patterns is attained.

[0027] This invention is carried out with various gestalten, without being limited to the gestalt of the above-mentioned operation. For example, although the chip attached in a cutter body was made into six pieces, it does not limit to six pieces. Moreover, although the radius of the curve of the cutting edge of a chip was set to 70mm, it does not limit to 70mm. Moreover, although rotational speed under processing of a milling cutter was set to 3000 - 8000rpm, it is good also as a larger rotational speed than 8000rpm. Since cutting force decreases so that it is made high-speed rotation, field roughness improves. Moreover, although applied to field processing, it is applicable to various cutting to the inside of a work piece etc.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is a milling cutter concerning this invention, and (a) is a front view and (b) is a top view.
[Drawing 2] It is the A-A line sectional view of (a) in drawing 1 .
[Drawing 3] It is drawing showing the tip configuration of the chip of the milling cutter concerning this invention.
[Drawing 4] It is the front view of the NC machine tool equipped with the milling cutter concerning this invention.
[Drawing 5] It is the typical top view showing the operation under face cutter processing by the milling cutter concerning this invention.
[Drawing 6] It is the typical top view showing the operation under face cutter processing by the conventional milling cutter.
[Drawing 7] It is drawing showing the tip configuration of the chip of the conventional milling cutter.
(a) It is a rough machining chip.
(b) It is a wiper chip.
[Description of Notations]
1 ... Milling cutter
2 ... Cutter body
3 ... Chip
4 ... Screw
5 ... Screw for a side clamp
6 ... Screw for adjustment
7 ... Clamp member
10 ... NC machine tool
11 ... Spindle
12 ... Clamp
D1, D2 ... Outer diameter of a cutter body
R1, R2 ... Radius of curve of the cutting edge of a chip
W ... Work piece
W1 ... The maximum width of a work piece

[Translation done.]

* NOTICES *

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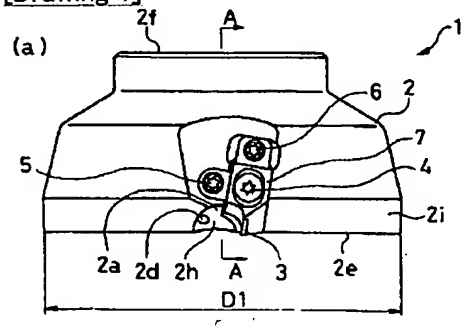
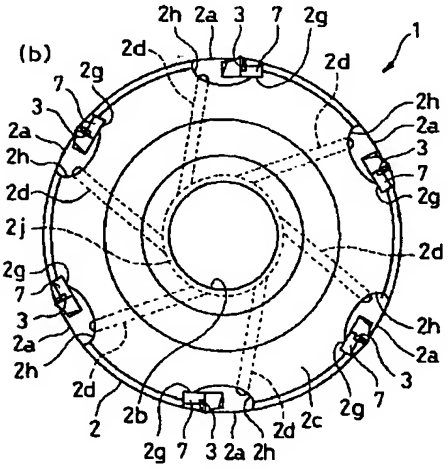
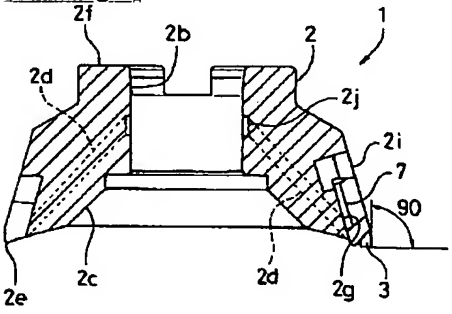
DRAWINGS

[Drawing 1]

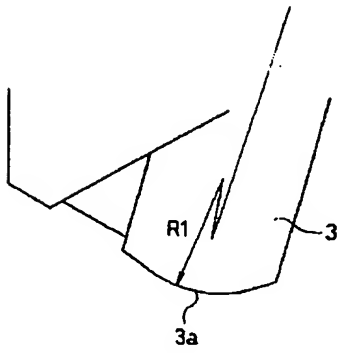




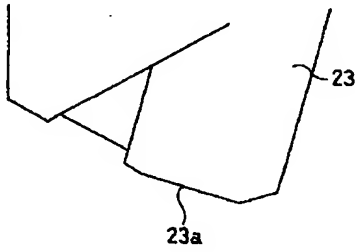
[Drawing 2]



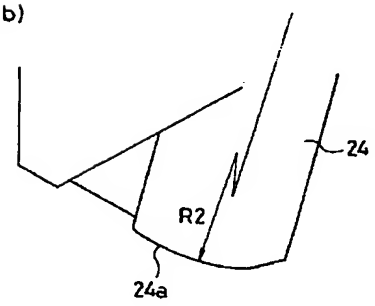
[Drawing 3]



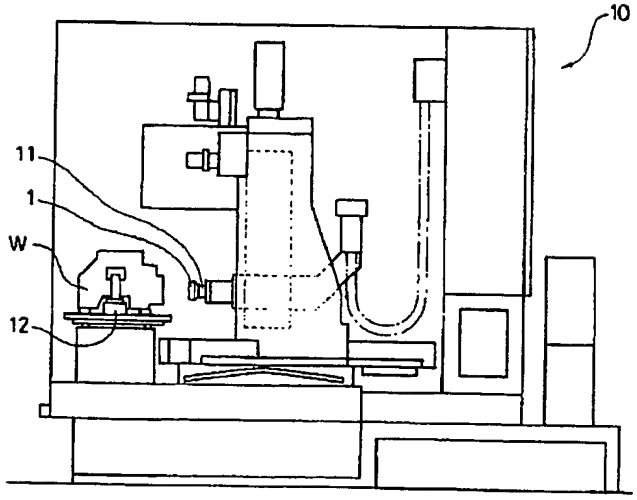
[Drawing 7]
(a)



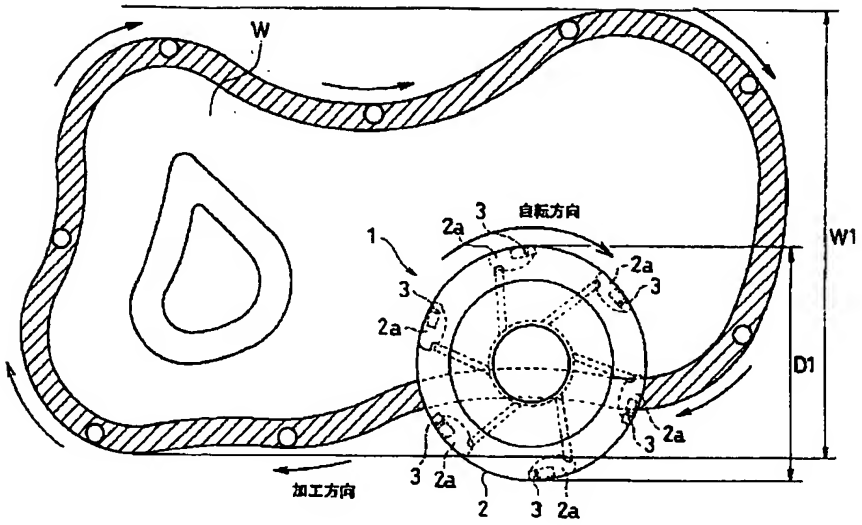
(b)



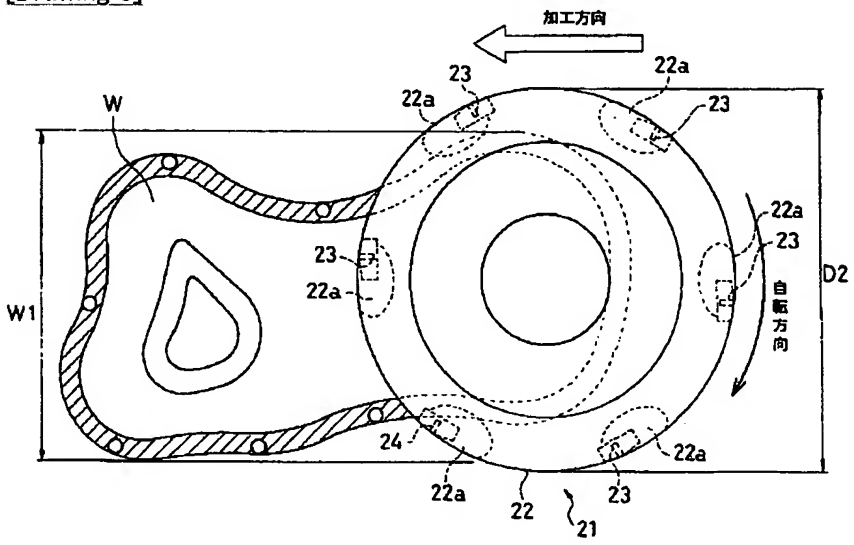
[Drawing 4]



[Drawing 5]



[Drawing 6]



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JP2000094211

Title:
MILLING CUTTER

Abstract:

PROBLEM TO BE SOLVED: To allow high-speed rotation, to make a wiper chip unnecessary and to effectively perform circular arc milling, by mounting plural even chips each having a same curved cutting blade of the same curve shape as a cutter body made of aluminum or the like, to the cutter body. SOLUTION: A cutter body 2 is formed of aluminum or an aluminum alloy having an especially high strength and an especially superior wear resistance. The cutter body 2 is formed in a disc shape such that an outside diameter of the cutter body 2 is gradually enlarged as it goes from an attachment side 2f to a cutting side 2e. A periphery edge part of the cutting side 2e is provided with six cutting parts 2a at even intervals, while each the cutting part 2a comprises a mounting part 2g for a chip 3 and a curved concave part 2h formed with a coolant hole 2d for jetting out a coolant during milling. The chip 3 having a cutting blade 3a formed in a curve shape is fixedly mounted to the mounting part 2g of the cutter body 2 with a screw 4, a side clamp screw 5 and a clamp member 7.

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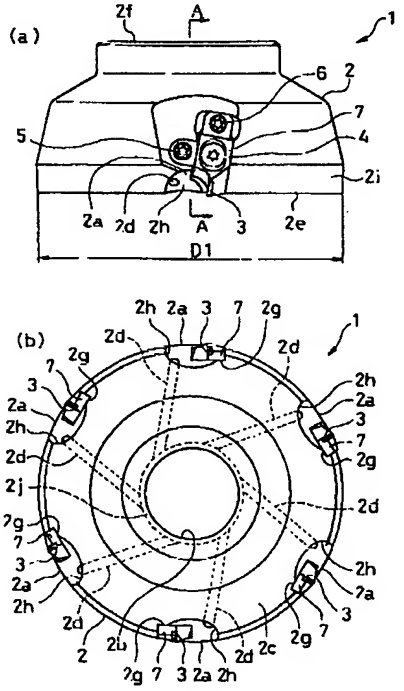
(71)出願人　000005326
本田技研工業株式会社
東京都港区南青山二丁目１番１号
(72)発明者　西川　恒生
三重県鈴鹿市平田町1907番地　本田技研工業株式会社鈴鹿製作所内
(72)発明者　北　正隆
三重県鈴鹿市平田町1907番地　本田技研工業株式会社鈴鹿製作所内
(74)代理人　100064414
弁理士　磯野　道造

Ｆターム(参考)　３Ｃ０２２　ＨＨ０１

(54)【発明の名称】　フライスカッタ

(57)【要約】
【課題】　高速回転対応かつワイパチップが不要であるとともに、円弧加工が可能でかつ高能率なフライス加工を可能とするフライスカッタを提供することを課題とする。
【解決手段】　ワークをフライス加工する際に使用するフライスカッタ１において、アルミニウムまたはアルミニウム合金で形成したカッタボディ２と、同一形状の曲線切刃を有する複数のチップ３とを備え、カッタボディ２に全て同一のチップ３を取り付け、高速回転でのフライス加工を可能とすることを特徴とする。



【特許請求の範囲】
【請求項１】　ワークをフライス加工する際に使用するフライスカッタにおいて、
アルミニウムまたはアルミニウム合金で形成したカッタボディと、
同一形状の曲線切刃を有する複数のチップとを備え、
前記カッタボディに全て同一の前記チップを取り付け、高速回転でのフライス加工を可能とすることを特徴とするフライスカッタ。
【請求項２】　切削部に連通するクーラント孔を前記カッタボディに設け、前記フライス加工中にクーラントを噴射することを特徴とする請求項１に記載のフライスカッタ。
【請求項３】　前記フライスカッタをＮＣ工作機械に用いることを特徴とする請求項１または請求項２に記載のフライスカッタ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、ワークをフライス加工する際に使用するフライスカッタに関し、特に、高速回転に対応し、かつワイパチップを不要とするフライスカッタに関する。
【０００２】
【従来の技術】従来、フライス加工は、ワークの平面を荒削りから仕上げまで切削するときによく用いられる。例えば、自動車用のアルミ製ミッションケース等のワークに対して切削加工を行う場合、正面フライス加工を採用している。正面フライス加工に使用するフライスカッタは、カッタボディに複数個のチップを取り付け、自転および平面移動等により切削加工を行う。
【０００３】図６は従来のフライスカッタ２１による正面フライス加工中の作用を示す模式的な平面図、図７は従来のフライスカッタ２１のチップの先端形状を示す図で（ａ）は荒削りチップ２３および（ｂ）はワイパチップ２４である。ワークＷの外周縁面（図６斜線箇所）を切削するために、フライスカッタ２１は、自転するとともに、図６の加工方向に沿って直線移動する。フライスカッタ２１は、カッタボディ２２の外周縁部に等間隔で６個の切削部２２ａを持つ。６個の切削部２２ａには、５つの荒削りチップ２３と１つのワイパチップ２４が各々取り付けられる。荒削りチップ２３は、直線形状である切刃２３ａを有し、荒削り切削用である（図７（ａ）参照）。ワイパチップ２４は、切刃２３ａより僅かに突出しかつ円弧状の曲線形状（Ｒ２＝３００ｍｍ）である切刃２４ａを有し、仕上げ切削用である（図７（ｂ）参照）。ワイパチップ２４は、荒削りチップ２３によって切削された加工面を円弧状に薄く削り、加工面を平滑にする。
【０００４】
【発明が解決しようとする課題】ところで、カッタボディ２２には１つだけ異なるワイパチップ２４を取り付けているので、正面フライス加工において直線加工しかできない。というのは、円弧加工した場合、仕上げ切削されない箇所が残る場合があるからである。そのため、ワークＷのように円弧形状を有する場合、ワークＷの最大幅Ｗ１（直線加工方向に対して垂直方向の幅）より大きい外径Ｄ２を有するカッタボディ２２を使用しなければならい。カッタボディ２２の大型化に伴い、フライス盤も大型のものを使用しなければならない。しかも、カッタボディ２２は、鉄製のため、重量が大きい。そのため、加工中の回転速度が３０００ｒｐｍ以下と低速回転となり、加工効率が低く、しかも面粗度も低い。
【０００５】そこで、本発明の課題は、高速回転対応かつワイパチップが不要であるとともに、円弧加工が可能でかつ高能率なフライス加工を可能とするフライスカッタを提供することとする。
【０００６】
【課題を解決するための手段】前記課題を達成した本発明に係るフライスカッタは、ワークをフライス加工する際に使用するフライスカッタにおいて、アルミニウムまたはアルミニウム合金で形成したカッタボディと、同一形状の曲線切刃を有する複数のチップとを備え、前記カッタボディに全て同一の前記チップを取り付け、高速回転でのフライス加工を可能とすることを特徴とする。
【０００７】しかも、前記フライスカッタにおいて、切削部に連通するクーラント孔を前記カッタボディに設け、前記フライス加工中にクーラントを噴射することを特徴とする。
【０００８】また、前記フライスカッタにおいて、前記フライスカッタをＮＣ工作機械に用いることを特徴とする。
【０００９】本発明のフライスカッタは、カッタボディをアルミ製として軽量化することによって、高速回転によるフライス加工に対応できる。また、高速回転によって、小さい半径の切刃を持つチップでも、仕上げ加工が可能となる。そこで、フライスカッタは、カッタボディに全て同一のチップを取り付け、荒削りから仕上げ加工までを行うとともに、円弧加工もできるようになる。しかも、カッタボディ内にクーラント孔を設け、クーラントを切削部に噴射することにより、切削加工で発生する摩擦熱を冷却し、かつ切削屑や加工バリ等を吹き飛ばすことができる。さらに、フライスカッタをＮＣ工作機械に装着するとともに、ワークの外周縁面等に沿って切削加工するために設定されたＮＣプログラムによって、直線加工や円弧加工等の様々な加工パターンに対応できる。
【００１０】
【発明の実施の形態】以下に本発明に係る実施の形態のフライスカッタを添付の図面を参照して説明する。図１は（ａ）にフライスカッタ１の正面図および（ｂ）にフ

ライスカッタ１の平面図、図２は図１（ａ）のＡ－Ａ線断面図、図３はフライスカッタ１のチップ３の先端形状を示す図、図４はフライスカッタ１を装着したＮＣ工作機械１０の正面図、図５はフライスカッタ１による正面フライス加工中の作用を示す模式的な平面図である。

【００１１】フライスカッタ１は、カッタボディ２の外周縁部に６個のチップ３を取り付けるとともに、６個の切削部２ａにおいてクーラント（冷却液）を噴射可能な構成である。なお、６個のチップ３は、全て同一の形状を有する。そして、フライスカッタ１をＮＣ工作機械１０（図４参照）に装着し、ワークＷを正面フライス加工で荒削りから仕上げ加工まで行う。

【００１２】カッタボディ２について説明する。（図１～図２参照）

カッタボディ２は、アルミニウムまたはアルミニウム合金で形成する。その中でも、高強度、耐摩耗性に優れるものを使用する。なお、本実施の形態のカッタボディ２の材料は、＜ＡＨＳ＞、T_6、Ａｌ－Ｓｉ－Ｃｕ－Ｍｇで、アルミニウム系の材料の中で非常に硬いものである。カッタボディ２は、アルミ製にすることによって、従来の鉄製のカッタボディに比較して非常に軽量となる。

【００１３】カッタボディ２の全体形状は、円盤形状を有し、装着側２ｆから切削側２ｅにかけて外径が徐々に大きくなる。なお、カッタボディ２の切削側２ｅの外径Ｄ１は、ワークＷの最大幅Ｗ１より小さくてもよい（図５参照）。というのは、本発明のフライスカッタ１は円弧加工に対応可能な構成であるため、ワークＷの外周縁面に沿ってのフライス加工が可能となるからである。そのため、従来の直線加工にしか対応できないフライスカッタ２１のように、ワークＷの最大幅Ｗ１より大きくする必要がない（図５参照）。なお、カッタボディ２の外径Ｄ１は、ＮＣ工作機械１０のスピンドル１１（図４参照）等によって限定される。また、カッタボディ２の外径Ｄ１は小さいほど有効で、面加工だけでなく、内面の加工等様々な加工に適用できる。その結果、カッタボディ２の重量は、アルミ化および小型化によって、従来のカッタボディの重量と比較して３分の１程度となる。

【００１４】装着側２ｆの中心部には、ＮＣ工作機械１０のスピンドル１１（図４参照）を装着するための中心孔２ｂを持つ。中心孔２ｂは、切削側２ｅに形成された開口部２ｃに連通する。カッタボディ２とスピンドル１１とは、中間アダプタの２面拘束ホルダー（図示せず）によって装着される。

【００１５】また、切削側２ｅの外周縁部には、等間隔に６個の切削部２ａを有する。切削部２ａは、チップ３を取り付けるとともに、切削時に切削屑や加工バリ等が詰まらないような構造を持つ。そのため、切削部２ａは、チップ３の取付部２ｇおよび湾曲凹部２ｈからなる。取付部２ｇは、チップ３、チップ３を固定する部材であるビス４、サイドクランプ用ビス５、クランプ部材７およびチップ３の位置を調整する部材である調整用ビス６を組み込むために、カッタボディ２の外周側面２ｉに凹形状を有する。他方、湾曲凹部２ｈは、カッタボディ２の外周側面２ｉに切削側２ｅの端部から略四半球状の凹形状を有する。また、湾曲凹部２ｈにはクーラント孔２ｄが連通し、加工時に、クーラントを切削箇所に噴射する。

【００１６】６個のクーラント孔２ｄは、カッタボディ２の中心部から６個の切削部２ａにかけて各々形成される。そして、各クーラント孔２ｄは、カッタボディ２の中心部のクーラント液供給部２ｊに連通する。クーラント孔２ｄからは、噴射圧７０ｋｇ／ｃｍ^2 の非常に高圧なクーラントを噴射する。そのため、噴射されたクーラントは、切削時にチップ３とワークＷとの間に発生する摩擦熱に対する冷却作用に加えて、切削時に発生する切削屑や加工バリ等を飛ばす作用も有する。

【００１７】また、カッタボディ２のバランスは、Ｇ２．０以下とする。Ｇ２．０以下にしないと、高速回転時に振動が発生し、切削加工が安定しないからである。

【００１８】チップ３について説明する。（図１～図３参照、従来は図６、図７参照）

チップ３は、カッタボディ２に６個取り付けるが、全て同一のものとする。チップ３の形状は、切刃３ａを曲線形状とし、その曲線の半径Ｒ１を７０ｍｍとする（図３参照）。従来、ワイパチップ２４の切刃２４ａの曲線の半径Ｒ２は、３００ｍｍと大きい。ワイパチップ２４は、大きい円弧の切刃２４ａでかつ低速回転で、仕上げ切削を行っていた。そのため、従来のフライスカッタ２１で荒削りから仕上げ加工まで行う場合、カッタボディ２２には複数のチップ２３，２４の中で１つだけワイパチップ２４を取り付けなければならなかった。しかし、フライスカッタ１を高速回転可能な構成にすることによって、切刃３ａの曲線の半径Ｒ１を小さくしても、仕上げ加工が可能となる。なお、高速回転によって切削抵抗が小さくなり、面粗度が向上する。また、切刃３ａの曲線の半径Ｒ１を従来のワイパチップ２４の切刃２４ａの半径Ｒ２より小さくすることによって、荒削りの作用も呈する。その結果、カッタボディ２に取り付けるチップ３を全て同一のものとしても、荒削りから仕上げ加工までを行うことが可能となる。さらに、Ｘ，Ｙ，Ｚ軸すべの方向に対しても加工が可能となり、面加工以外に対応できる。

【００１９】チップ３のカッタボディ２への組み付け構造について説明する。（図１～図２参照）

チップ３は、カッタボディ２の取付部２ｇに、ビス４、サイドクランプ用ビス５およびクランプ部材７によって固設する。まず、チップ３は、取付部２ｇに配設されたクランプ部材７に組み付け、チップ３のビス孔（図示せず）にビス４を螺入させてビス締結固定する。なお、こ

の組み付けに際し、フライスカッタ１の切削面と側面とのなす角を９０°とする（図２参照）。さらに、サイドクランプ用ビス５で、チップ３の側方から固定する。また、チップ3は、調整用ビス６で、カッタボディ２から切刃３ａの突出量を調整可能である。

【００２０】上記のように、チップ3は、クランプ方式をビスタイプとした。というのは、フライスカッタ１は高速回転で加工を行うので、チップ３には大きな遠心力がかかるため、ビス４で固定強度を大きくし、さらに、サイドクランプ用ビス５で固定を強化するためである。

【００２１】フライスカッタ１をＮＣ工作機械１０に装着した状態について説明ずる。（図４参照）

フライスカッタ１は、ＮＣ工作機械１０のスピンドル１１に２面拘束ホルダー（図示せず）によって装着する。なお、２面拘束ホルダーを使用することによって、フライスカッタ１とスピンドル１１間の引き込み力を向上させ、高速回転時に発生する大きな遠心力に対応可能とした。また、ワークＷは、ＮＣ工作機械１０のクランプ１２に保持され、フライスカッタ１によって切削加工される。

【００２２】なお、ＮＣ工作機械１０での加工中、フライスカッタ１は、回転速度を３０００～８０００ｒｐｍとする。高速回転になるほど、切削抵抗が減るので、面粗度が向上する。なお、３０００ｒｐｍとすると、面粗度が落ち、加工効率も低下する。

【００２３】フライスカッタ１による正面フライス加工中の作用について説明する。（図５参照）

フライスカッタ１は、ＮＣ工作機械１０（図４参照）に装着され、正面フライス加工する。フライスカッタ１は、カッタボディ２の軽量化および小型化、かつチップ３の同一化によって、高速回転加工かつ円弧加工が可能となった。したがって、ワークＷの外周縁面（図５斜線部）に沿った円弧加工および直線加工を組み合わせた加工パターンのフライス加工が可能となる。また、Ｘ，Ｙ，Ｚの３軸方向の加工も自由に行うことができる。

【００２４】フライスカッタ１は、ＮＣ加工プログラムに従って、高速回転による自転およびワークＷの外周縁面に沿って正面フライス加工を行う。しかも、カッタボディ２の軽量化によって、回転速度が高速回転であることとともに、加減速時間も大幅に短縮できる。その結果、従来に比較して、高能率な正面フライス加工が可能となる。なお、加減速度は従来より３倍程度、加工能率は従来より５倍程度にアップ可能である。

【００２５】また、高速回転によって、切刃３ａの曲線の半径Ｒ１がワイパチップ２４の切刃２４ａの半径Ｒ２より小さくても（図３、図７参照）、仕上げ加工を可能とした。すなわち、半径Ｒ１の小さい分を高速回転で補う。その結果、フライスカッタ１は、荒削りから仕上げ加工まで可能となる。なお、荒削りから仕上げ加工まで同じ回転速度で行う。しかも、高速回転によって切削抵抗が減るので、面粗度が従来より向上し、さらに、切刃３ａの半径Ｒ１が小さくても、回転が高速になれば、面粗度は向上する。

【００２６】上記のフライスカッタ１は、アルミ製による軽量化によって、高速回転を可能とした。また、高速回転可能な構成とすることによって、チップ３の曲線切刃３ａの半径Ｒ１を小さくしても、仕上げ加工が可能となった。その結果、カッタボディ２に取り付けるチップ３を全て同一のものとしても、荒削りから仕上げ加工まで可能となる。しかも、チップ３を全て同一としたことによって、円弧加工が可能となる。そのため、カッタボディ２を小型化でき、ＮＣ工作機械１０等に装着して様々な加工パターンでの切削が可能となる。

【００２７】本発明は、上記の実施の形態に限定されることなく、様々な形態で実施される。例えば、カッタボディに取り付けるチップを６個としたが、６個に限定するものではない。また、チップの切刃の曲線の半径を７０ｍｍとしたが、７０ｍｍに限定するものではない。また、フライスカッタの加工中の回転速度を３０００～８０００ｒｐｍとしたが、８０００ｒｐｍより大きい回転速度としてもよい。高速回転にするほど、切削抵抗が減るので、面粗度は向上する。また、面加工に適用したが、ワークの内面等への様々な切削加工に適用できる。

【００２８】

【発明の効果】上記のように、本発明に係るフライスカッタは、高速回転に対応でき、かつワイパチップを不要とし、全て同一のチップで荒削りから仕上げ加工まで可能である。また、チップを全て同一のものとすることによって、直線加工のみならず、円弧加工も可能となる。しかも、カッタボディを小型化かつ軽量化したので、従来のカッタボディの３分の１程度の重量となるとともに、フライス盤も小型化できる。さらに、高速回転に対応可能とすることによって、スピンドル加減速度が従来より３倍程度、加工効率が従来より５倍程度に向上するとともに、面粗度も向上する。

【００２９】また、切削部にクーラントを噴射する構造とすることにより、冷却作用とともに、切屑や加工バリ等を飛ばす作用も奏する。さらに、円弧加工等も自由にできるので、ＮＣ工作機械等に装着して、様々な加工パターンによる切削が可能となる。

【図面の簡単な説明】

【図１】本発明に係るフライスカッタで、（ａ）は正面図、（ｂ）は平面図である。

【図２】図１における（ａ）のＡ－Ａ線断面図である。

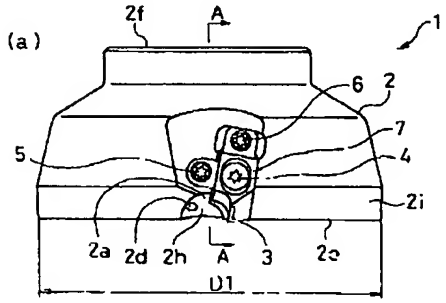
【図３】本発明に係るフライスカッタのチップの先端形状を示す図である。

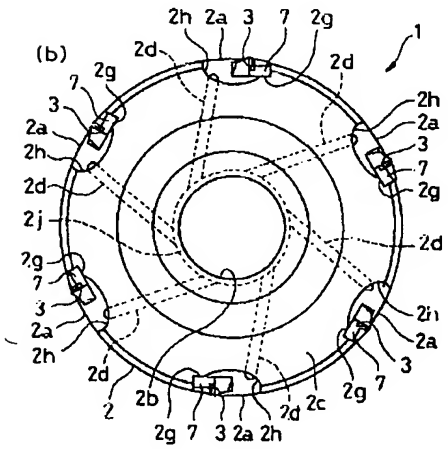
【図４】本発明に係るフライスカッタを装着したＮＣ工作機械の正面図である。

【図５】本発明に係るフライスカッタによる正面フライス加工中の作用を示す模式的な平面図である。

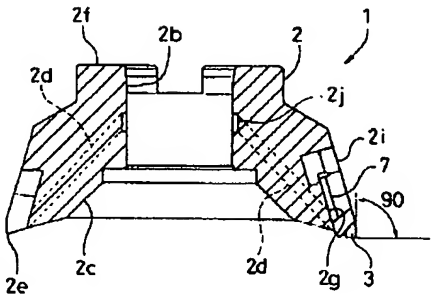
【図6】従来のフライスカッタによる正面フライス加工中の作用を示す模式的な平面図である。
【図7】従来のフライスカッタのチップの先端形状を示す図である。
（a）荒削りチップである。
（b）ワイパチップである。
【符号の説明】
1・・・フライスカッタ
2・・・カッタボディ
3・・・チップ
4・・・ビス
5・・・サイドクランプ用ビス
6・・・調整用ビス
7・・・クランプ部材
10・・・NC工作機械
11・・・スピンドル
12・・・クランプ
D1，D2・・・カッタボディの外径
R1，R2・・・チップの切刃の曲線半径
W・・・ワーク
W1・・・ワークの最大幅

【図1】

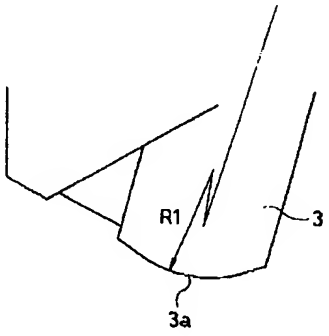




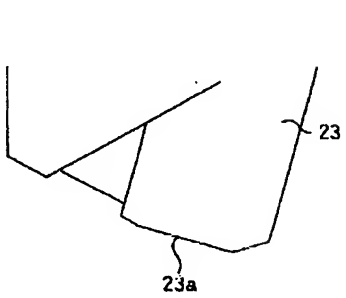
【図2】

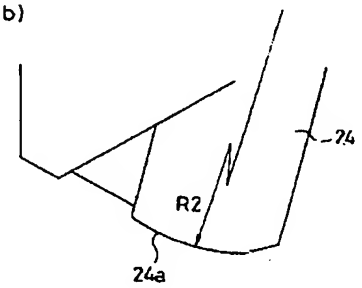


【図3】

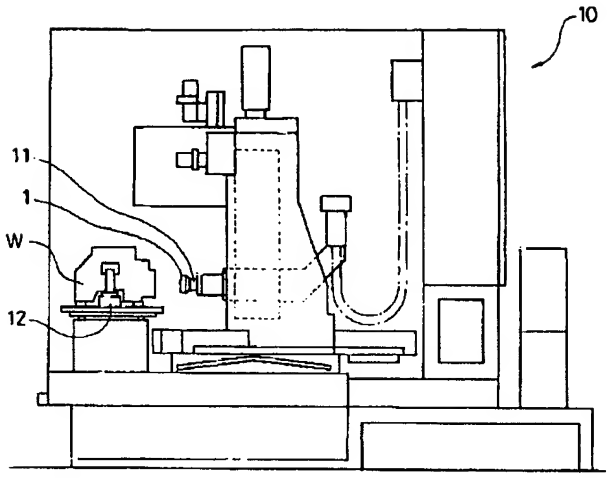


【図7】

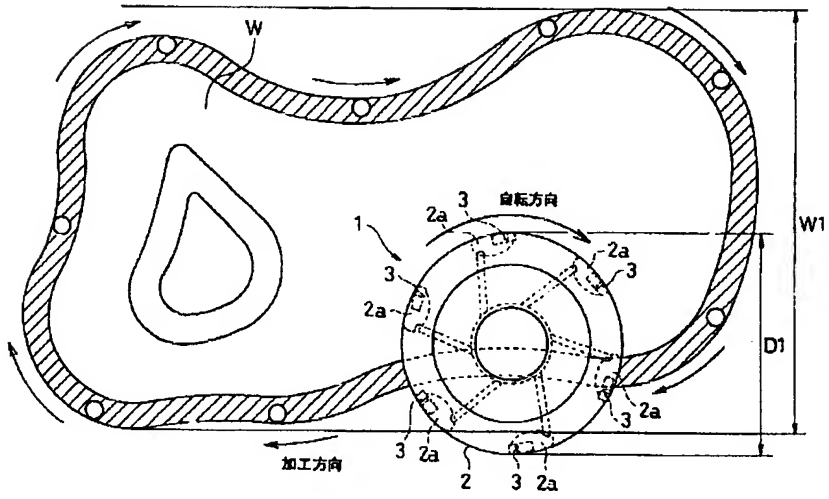




【図4】



【図5】



【図6】